SENSITIVITY AND UNCERTAINTY ANALYSIS OF NUCLEAR RESPONSES IN THE EU HCLL TBM OF ITER

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In the past years dedicated computational methods, tools and data have been developed for sensitivity and uncertainty analyses of nuclear responses in the frame of the EU Fusion Technology Programme. Those analyses have been performed mainly to assess uncertainties of nuclear responses in fusion neutronics experiments. In particular, the two blanket mock-up experiments on the Helium Cooled Pebble Bed (HCPB) and Helium cooled Lithium Lead (HCLL) variants conducted at the Frascati Neutron Generator have been analyzed thoroughly. The overall objective of the combined theoretical and experimental effort is to provide reliable nuclear data and computational tools for the design analyses of fusion devices like ITER including qualified uncertainty estimates.

In this respect, the present paper reports on sensitivity and uncertainty analyses for the EU HCLL Test Blanket Module (TBM) of ITER. Neutron flux spectra, tritium production rates and other nuclear parameters of interest for the designers have been calculated using MCNP with a modified version of the ITER Alite torus sector model with integrated TBMs. Sensitivities of such parameters to nuclear cross sections of isotopes contained in the TBM as well as in the ITER device have been calculated using the Monte Carlo code MCSEN. Uncertainties could be obtained by using existing co-variance data of the important nuclear cross section files, mainly from ENDF/B-VI, SCALE6.0, but also from recent JEFF/EFF evaluations. As in the HCLL mock-up experiment two positions at front and back of the TBM have been selected. In both cases the calculated uncertainties of the responses (tritium production rate, neutron flux) are in the range of 2 to 4 %.

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